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Presidential Address - Two Centuries of North American Lichenology

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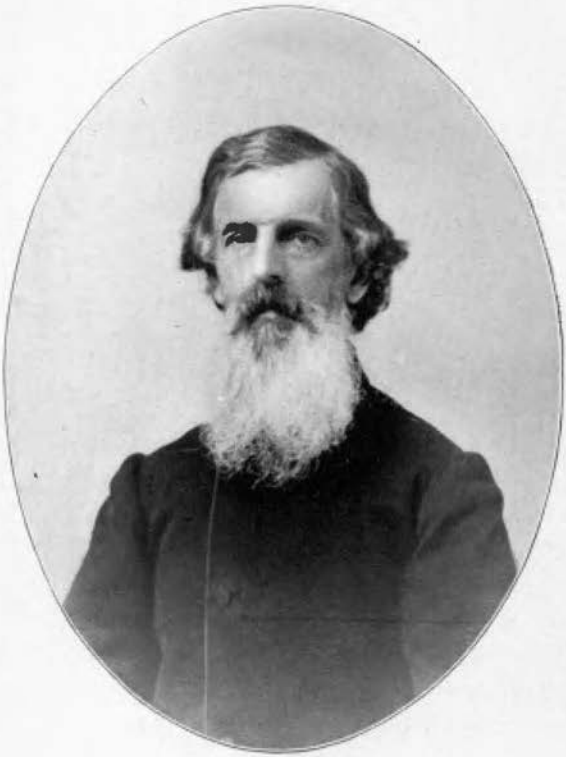
PLATE I.



EDWARD TUCKERMAN, 1817-1886.

PRESIDENTIAL ADDRESS.

TWO CENTURIES OF NORTH AMERICAN LICHENOLOGY.

BY BRUCE FINK.

PRELIMINARY STATEMENT.

Surely no apology is in order for offering here an address in which attention is directed for the short time to a limited field in one of the biological sciences. All men of science are interested to some extent in the history of the rise and progress of every phase of scientific inquiry, and even for the layman who may favor us with his presence this evening, it is hoped that the record of devotion, sacrifice and completion of valuable work will afford something of interest.

The history of American lichenology, so far as we have been able to trace its tangible origin, begins with the year 1703, when appeared the first list of American lichens. However, lichenology in America is not a thing apart, but its beginning and much of its development are closely related to the work in Europe, begun considerably earlier and always in advance of our own. Lichens have for at least two centuries excited more than passing interest in our own country, but we are yet too young a nation to have produced a large number of workers especially interested in a class of plants, comparatively inconspicuous, and having little economic value of such a nature that one may find a livelihood in their study. So it happens that lichens frequently receive some attention as objects of nature study both for children and adults, and are studied

by some ambitious young botanist long enough to complete a list of the commoner species of his locality or State; but as a rule the botanist, true to the American instinct, soon turns his attention to some lucrative employment of his botanical training. In spite of all this, the record of the work accomplished is creditable, and even in recent years in which the trend of botanical activity has been rather away from taxonomic studies, American lichenists have, by turning in part toward morphological, physiological and ecological studies, and by persistence in taxonomic labors as well, produced a good amount of valuable work. While some of the results obtained in Europe in the last two decades are the best, whether of the taxonomic, morphological or physiological study of lichens.

EUROPEAN LICHENOLOGY AND ITS INFLUENCE ON AMERICAN.

So intimate is the relationship between American and European lichenology that a brief review of the latter is necessary in order to understand the former. While very little has been written regarding the history of American lichenology, the array of papers treating European lichenology, from the historical standpoint is too formidable for consideration here. However, Kremplehuber, in his "Geschichte und Litteratur der Lichenologie", in three volumes dealing with the lichenology of all lands from the beginning till 1870 in a most comprehensive manner, gives the facts from which we may draw for our view of European lichenology, and from which we may also gain valuable knowledge regarding American lichenology. Krempelhuber seems to make nearly all of his periods begin with years in which appeared some remarkable work in lichenology. As to the first period, his dates are somewhat uncertain and confusing, but he makes it begin with the earliest times and doubtless intends that it shall extend to 1694, the year in which appeared Tournefort's "Elemens de Botanique", in which for the first time the lichens are separated from the mosses, algae and fungi. His second period, as best we can make out from his dates, extends

from 1695 to 1728, or from Tournefort to Micheli. The third period covers the time from 1729, in which appeared Micheli's "Nova Plantarum Genera juxta Tournefortii Methodum Disposita", in which attention is called for the first time to the impropriety of grouping all lichens under the single genus, *Lichen*, to 1779, or to Weber, whose name also seems to appear as Wigger. Period four reaches from 1780, in which year Weber in his "Primitiae Florae Holsatiae" (the author's name appearing as Wigger) successfully departed from the old custom of classifying lichens entirely according to the general form and structure of the thallus and considered also the apothecia, to 1802, or to Acharius. The fifth of Krempelhuber's periods extends from 1803, in which year Acharius, in his "Methodus Lichenum", for the first time gave somewhat adequate descriptions of all known lichens, to 1845 or to DeNotaris. Krempelhuber's sixth and last period extends from 1846, when appeared De Notaris' "Frammenti Lichenographici", in which for the first time some prominence is given to spore characters in the classification of lichens, to 1870, in which year Krempelhuber completed his history in the third volume of his "Geschichte." Schneider in his recent "Textbook of Lichenology", presents a somewhat different division into periods, which is as a whole scarcely an improvement upon Krempelhuber's method of division. However, we may well agree with Schneider that the announcement by Schwendener of his belief in the dual nature of lichens in 1868 may be regarded as the beginning of a new period, the importance of this announcement hardly appearing before Krempelhuber had completed his work. Schneider also recognizes another period beginning with the year 1894, when appeared Reinke's "Die Stellung der Flechten in Pflanzensystem", in which the author put forth his views regarding the autonomous nature of lichens and the consequent propriety of still regarding them as a distinct class of plants. This is by no means Reinke's only contribution to lichenology, and no one who has seen his papers can doubt their great value. However, there is as yet no great evidence that his peculiar views as to the autonomy

of lichens will ever be generally accepted, and the present writer is disposed to regard the establishment of a period dating from 1894 as at least premature.

Regarding the early studies in the old world, Theophrastus, in the third century before Christ, seems to have named a number of lichens, giving very crude descriptions. *Usneas* and other conspicuous forms, including *Roccella tinctoria*, on account of its coloring properties, seem to have been the lichens thus early described. A few observers also studied lichens somewhat during the first century of the Christian era; but the dark ages soon intervened, and for several centuries, lichenology was, like other sciences, wholly neglected. With the revival of the sixteenth and seventeenth centuries, a few of the more conspicuous lichens were again described. As already stated, it was not till 1694 that lichens were for the first time recognized as a distinct group of plants, and at this time less than a hundred species were known. Such was the condition of the science of lichenology when the first work was done in America.

The men who did this early work were not specialists in lichenology, for specialists in so limited a sense were hardly known at this time. But toward the close of the eighteenth century, there appeared a number of botanists who began to study the lichens somewhat seriously. Though careful study of the old literature has given me but 221 pre-Linnean (1753) lichens, Acharius, the first great lichenist, in his "Methodus Lichenum," just a half century later (1803) described approximately 500 lichens then known. Such were the conditions at the beginning of the second century of American lichenology, and it may be added that the prevailing ideas regarding the apothecia, the soredia, the so-called spermagonia, the spermatia and the spores were crude and in general erroneous. It is true that Acharius studied the spores as well as he could with the crude magnifiers of his day, and figured many apothecia, but even in his "Lichenographia Universalis" of 1810, his attempts at figures of spores are few and very unsatisfactory.

Early in the nineteenth century, monographs of genera began to appear in Europe, and after the first quarter of the century, European lichenists of note became so numerous that we can mention only a few of them in passing. Wallroth, Körber, Massalonge and Nylander, each in turn did much for systematic lichenology in Europe during the century just closed and helped directly or indirectly in our studies as well, while perhaps Elias Fries, through his influence upon Tuckerman, impressed himself upon American lichenology more than any one of them. Arnold, Stizenberger and Müller also aided greatly in the closing years of the last century, and Wainie, Zahlbruckner and Hedlund are among the Europeans who have, in the present century, aided effectually in our work.

Wallroth did good work for his day in the morphology and physiology of lichens, and other European workers in these fields have profoundly influenced our American thought and must be mentioned. About the middle of the last century appeared works by DeBary and Schwendener, which were the beginning of a revolution in ideas regarding the nature of lichens. De Bary detected the close relationship between the lichens and the algae on one side and the fungi on the other, and Schwendener, at first hostile to the views of De Bary, in 1868 announced his belief that the so-called gonidia and gonimia were really algae growing under peculiar conditions. He set to work to study the algal types occurring in lichen thalli, and received credit for establishing the now generally accepted view as to the dual nature of lichens. The fungal portion of the lichen commonly gives form to the plant, or colony, and produces the spores, and American as well as European writers of text-books soon began to follow De Bary and Schwendener, placing the lichens among the fungi. The older systematic lichenists of two continents were almost violently hostile to the new theory, and many of the younger and better trained lichenists and botanists, who accept the newer views as well established, have not felt so certain that the distribution of lichens among fungi is at all a final disposition. Finally, Reinke, in a paper already mentioned, and

published a decade since, has, with some show of good reasoning founded upon recent experiments, attempted to introduce into the scientific world the idea that the relation between the algae and the fungus or the fungi of the lichen colony is so close that we have not a colony but an autonomy. Enough was stated on a previous page regarding the views of Reinke, and it need only be reiterated that, though not yet generally accepted, they are not to be passed over lightly, nor need botanists suppose that the question as to the classification of lichens is at all settled, much as such a consummation is to be desired. But leaving this matter, Bonnier, Fünfstuck, Jumelle, Lindau and Zukal must all be mentioned as men whose works will influence American lichenology increasingly as we turn our attention more and more toward morphological and physiological studies. Nor may we leave the consideration of the impress of European upon American lichenology without reference to the name of Stahl, whose work is well known to American botanists.

INTRODUCTORY VIEW OF AMERICAN LICHENOLOGY.

It must be apparent enough that in discussing American lichenology, it would not be at all satisfactory to follow the outline of periods adopted in a study of general lichenology, and we shall introduce here a division into periods, which will at least serve our purpose. Acharius in his "Lichenographia Universalis", 1810, for the first time definitely mentions a considerable number of American lichens in a work of first importance, and we may fittingly regard the work done before 1810 as belonging to *The Period of Beginnings.* During this period and following it the impress of Europe was even more plainly noticeable in American lichenological studies than it has been in more recent times. In 1847 was read Tuckerman's "Synopsis of the Lichens of the United States and British America" (published the following year), and in the same year Tuckerman also began to issue his exsiccati under the name, "Lichenes Americae Septentrionalis Exsiccati".

These being the first really important works by an American, it will be seen that from 1810 to 1847 we were emerging somewhat from the influence of Europe, and the time included between these two dates we may appropriately regard as *The Euro-American Period* of American lichenology. In 1888, two years after the death of the author, appeared the second volume of Tuckerman's "Synopsis", which closed the work of this great Lichenist. From 1847 to 1888 the influence of the one man, Tuckerman, was plainly to be seen upon nearly all of the work done in American Lichenology, and we may consider this time as *The Tuckermanian Period.* It is not to the discredit of Tuckerman that we are pleased to record that since his death there has been a gradual breaking away from ideas held by him and his co-workers as to the nature and proper classification of lichens, and since we are in want of a better name, we may call the time subsequent to 1888 *The Recent Period* of American lichenology. The change going on is perhaps most plainly outlined in Schneider's "Text-Book" and in his more elementary "Guide", but it is apparent also in some papers published in the present decade, and a considerable amount of material still in manuscript will, it is hoped, bring needed changes in synonomy, description of the species and classification.

THE PERIOD OF BEGINNINGS (FROM THE BEGINNING TO 1810.)

If we compare the outline of American lichenology suggested above with that previously given for Europe, it appears that the date, 1810, taken as the close of our first period, is only eight years later than that which closes the fourth of Krempelhuber's periods. Comparing a little further, we find that the date of the first definite and certain mention of a North American lichen, 1703, is just nine years after the close of the first of Krempelhuber's periods. Thus it seems that the work on lichens began in our land as soon as these plants were recognized as distinct from mosses, algae and fungi, and at a time when only about 75 lichens were known—possibly 100. Botanical work

had been done before this time in America, for as early as 1643 a course of one hour a week in Botany was established at Harvard. This was more than a century before the first American professor of Botany, Adam Kalm, was, about 1768, installed at the University of Pennsylvania. The first serious collecting of plants in our country seems to have been done by Thomas Walker in South Carolina, in 1740, and following him Kalm collected and sent to his teacher, Linneus. Michaux, in 1780, began his famous trip through the South and West to the Mississippi river, culminating in his flora of North America with 1700 plants, and Pursh, Nuttall, Houston and Clayton followed shortly and aided in the early work. Of these men, Michaux and Walter at least collected some lichens. However, American lichenology can be traced back nearly a half century before any of this collecting was done, to a time when our botanical science in general was in a rudimentary condition. Possibly some of the semi-civilized peoples of North America may have known some lichens as long ago as the days when Theophrastus and later the elder Pliny seem to have known something of them, and when the Greeks supposed plants to possess mind and soul and to be capable of pleasure and pain. Again, some of the early settlers in America may have done some obscure work on lichens and may have carried some specimens to Europe where they were perhaps studied, but the first definite record that I am able to find is that Carolus Plumier, in his work published in 1703 at Paris, records *Sticta damaecornis*. Thus so far as tangible evidence is concerned, North American lichenology appears to be just about two centuries old. This work of Plumier's appeared a half century before Linnaeus had devised the binomial system of plant names, and the plant was designated, *Lichen rufescens, cornua, damae referns*, from resemblance of the thallus lobes to buck horns. It is not so strange that this plant, no doubt picked up by chance, happened to be new to science when we recall that the whole number of lichens known at this time was less than 100. Petiver, in a work published in London, 1712,

mentions this same American lichen and no more. However, it must be stated also that Petiver had, in the second century of his mosses in 1695 (Petervarini Musci Cent.) sent out *Parmelia perforata*, under the descriptive designation, *Lichen arboreus Americanus scutellis magnis donatus;* but I am unable to ascertain whether from North or South America. Also, H. Sloane in his "Catalogus Plantarum Jamaicae," London, 1696, is said to have mentioned seven species of previously known lichens under some sort of classification. This work I have not yet investigated sufficiently to be certain but that we should carry our history back to 1696 at least. But turning to tangible things, our *Sticta damaecornis* is the eighty-sixth known lichen recorded by Kremplehuber, and the title under which the plant appears is the forty-first of his references to lichen literature. Next in order, it is certain that Gronovius in his "Flora Virginica," 1739-1743, listed nine North American species with short diagnoses. Among these were *Evernia lacunosa*, *Parmelia perforata* and seven other very common and conspicuous species. After an interval of four decades, we hear of the study of American lichens again through the work of O. Swartz in the West Indies, 1783–1808. In three editions of his work, he gives lists, descriptions and illustrations of 25 lichens. These are common plants, all recorded in Krempelhuber's "Geschichte," and these pages need not be burdened with the names, though it may be in order to state that all but the last three were placed under the genus, *Lichen.* During these years, H. Muhlenberg, in his "Index Flora Lancastriensis," 1793, gives a list of 27 species with no authorities and all under the genus, *Lichen.* Also in 1803, Michaux, in his "Flora Boreli-Americana," noticed 21 species of North America, of which 7 new ones may be found listed in Krempelhuber's "Geschichte." Likewise, in 1803 appeared Acharius' "Methodus," in which are mentioned with descriptions a considerable number of North American lichens, but usually without any statement as to distribution, so that it is impossible to know just which ones the author knew from America.

Thus closes our first period with a record of 12 titles, counting the four by Schwartz not separately mentioned above, "Species Plantarum" which notices a few lichens from North America and Thomas Walter's "Flora Caroliniana," 1788, which gives 5 under the name, *Lichen*. Plainly this is the period of beginnings, and it becomes apparent that we are still considerably behind Europe in licheno-studies at the close of the period when it is stated that at the time there were no less than 190 papers and books recording lichenological work in Europe, and by no means all taxonomic. Of these European titles 54 are pre-Linnean (before 1753). But beginnings there must be, and the books and papers discussed above are interesting and important in that they prepared the way for more extended studies.

THE EURO-AMERICAN PERIOD (1810-1847)

Passing to the second period of North American lichenology, we must mention first the great work of Acharius, "Lichenographia Universalis," in which are described a few more than 100 of our lichens, for the most part collected by Schwartz, Muhlenberger, Michaux and Menzies during the previous period. In this great work by Acharius are described only 786 lichens, so that figures prove that our known lichen flora of the time amounted to somewhat more than one-eighth of the total for the world. "Lichenographia Universalis" appeared in 1810 and "Methodus Lichenum" by the same author in 1814. This second work is also valuable for American lichenists, and it may be said that the two works by this early European lichenist made possible, or at least led to, the appearance of some distinctly American works, dealing in part or wholly with our lichen flora. Of these the first is Muhlenberg's "Catalogue of Plants of North America," published at Philadelphia in 1818 and containing a list of 184 North American lichens. This is the first considerable list of our lichens published in America, and the number is large for the time. In passing it is only fair to note, however, that Amos Eaton in his "Manual of Botany of North America,"

the edition of 1817, gave a much shorter list based mostly upon the work of Muhlenberg. In 1819, in "A Catalogue of Plants growing spontaneously within thirty miles of New York," John Terrey also gave a list of 66 lichens. This is simply a record of species already known, but the list is the first considerable local one for a small North American area. A. Halsey, in 1823, in his "Synoptic View of the Lichens Growing in the Vicinity of the City of New York," gave a list of 176 lichens with short diagnoses. This is the first work devoted wholly to North American lichens and published in this country, and it gives nine new species, named by Schweinitz. Halsey's 176 lichens for the single locality appears noteworthy when we state that the whole number of lichens known in the State of New York at the present time is 241. Though Pennsylvania and New York are entitled to early pre-eminence in lichen studies, New England comes to the front toward the close of the period and more especially in the next period. So far as we are able to ascertain, besides Tuckerman's beginnings to be considered later, a single catalogue of the present period gives any notice to New England lichens. This is "A Catalogue of Animals and Plants of Massachusetts" by Edward Hitchcock, in which he gives a list of 116 lichens. This catalogue appeared in 1833, and in the following year T. Nuttall, in his "Catalogue of a Collection of Plants made chiefly in the valleys of the Rocky Mountains or Northern Andes" by A. B. Wyeth, lists three lichens. This work is barely worthy of note as the first American paper giving a record of lichens from western North America. Menzies had collected considerably on the Pacific coast before this time, but we find nothing previously published in this country regarding his work. Before passing to a brief notice of the portion of Tuckerman's work belonging to the present period, we need only note further that Olney had listed three lichens in Rhode Island and that Russell, about 1840, noted 18 or 20 in Massachusetts, that from 1822 to 1838 Hooker, Presl, Bachelot, Wickstrom, Meyer and Ramon had all published more or less regarding our lichen flora, in Europe, and

that C. H. Persoon had in the opening year of the period (1810), in a work published in Europe, given a list of 42 lichens from San Domingo and the North American continent. Finally taking up Tuckerman's beginnings, which belong to this period, we find that he published in five papers (1839–1845) on the lichens of New England, lists aggregating upward of 200 species and varieties. Also in 1845 appeared "An Enumeration of North American Lichenes with a preliminary view to the Structure and General History of these Plants and of the Friesian System," in which are enumerated 238 North American lichens. Of these only three are new, and this indicates that Tuckerman had not yet begun any extensive species-making. A list of 53 species given in T. G. Lea's work on the plants near Cincinnati appeared in 1846, this completing our survey of Tuckerman's works of the period.

Thus the period begins with a few more than 100 known North American lichens and closes with scarcely 250. With the exception of the few species known from the western coast and mountains, the work was mostly confined to the New England states, New York, Pennsylvania and Ohio. American papers appear as already noted, and some of them would appear quite noteworthy even at the present time. The whole number of titles for the period is 39, and it is not thought necessary to name the minor ones.

THE TUCKERMANIAN PERIOD (1847-1888.)

In taking up this period we pass from comparatively small things to what Henry Willey fittingly called "the golden age of American lichenology". During this time, everything in American Lichenology was colored by the views of the one man, Tuckerman. However, in dealing with the period, it seems expedient to consider the work of others first and close with that of the man who stands pre-eminent among American lichenists. Among Europeans who have worked on our lichens during the period, we can give space only to Th. M. Fries and W. Nylander. Fries in his "Lichens Arctio Europae, Grönlandicaeque", pub-

lished in 1860, mentions a considerable number of our lichens with descriptions. In a few minor papers also, Fries touches North American lichens, but Nylander, who at the time of his death was undoubtedly first in his knowledge of lichen species, influenced American lichenology of the period more than any American except Tuckerman, and possibly Henry Willey. Nylander's titles dealing wholly or in part with our lichen flora number no less than two dozen. Of these, eight are manuals or monographs, dealing with the general distribution and taxonomy of lichens as a whole or with certain genera, and belong to the present period. Of the remaining 16 titles, all but three belong to the present period, and the 16 contain descriptions of nearly 200 new North American lichens. This is a rather remarkable contribution for a foreigner, but Nylander was doubtless too much given to species-making; and it is not a little unfortunate that he depended too much upon chemical tests in his determinations, while his diagnoses belong to the older, rather brief and inadequate type. So far as we are able to ascertain, this great lichenist began his work on American lichens with the publication of "Lichenes collecti in Mexico", a Fr. Müller, in 1858, and his interest in our flora never waned till the closing year of his life, his death occurring in 1899. In 1895, on sending Nylander a copy of "The Lichens of Iowa", he says in his reply, "Vous etes dans l'erreur ent disant" "it is generally admitted that a lichen is a dual organism" "Cela n'est qu'une calomnie et n'est nullement serieux". Having begun my work on lichens about the close of the period with which we are now dealing I was surely serious in the statement, and calumny was farthest from my thought. However, doubtless the words quoted express not only Nylander's view, but also that of nearly all of the older systematic lichenists of America and Europe, with some of whom I was beginning to correspond at the time.

Krempelhuber, in his "Geschichte," gives the original names of nearly all American lichens described previous to 1870 and also furnishes a very valuable review of our

literature, previous to that date. Indeed, this work is indispensable to the American lichenist. Likewise, some of the European lichenists placed in the next period did some work in the present.

Among American botanists who have contributed to our knowledge of lichens, may be mentioned first the eminent botanist, W. G. Farlow. Dr. Farlow will not be known as a lichenist especially, but as a student in his laboratory I came to know that with his minute knowledge of algae and fungi is found also an accurate and wide knowledge of our lichens. He has published but few papers on lichens, and those that concern our North American flora appeared during the present period.

Turning to men who will be known more especially as lichenists, we may consider first the work of Henry Willey. After Tuckerman and probably Nylander also, Willey was the largest contributor to American lichenology during the period. So far as I have been able to ascertain, his first paper appeared in 1867, and his titles number no less than 27. Of these the most important are his "Introduction to the Study of Lichens," 1887; his "Synopsis of the Genus Arthonia," 1890; and his "Enumeration of the Lichens of New Bedford," 1892. The last two works were published during the next period, but the work was largely done during the period now under consideration. His work on the New Bedford lichens is surely the most complete survey of a limited area known to American lichenology, the whole number of species and varieties resulting from thirty years of study coming within a few of 500, of which 39 were new when found by Willey. His work on *Arthonia* is the only production by an American in the nature of a monograph of a lichen genus. The work is a compilation of 350 known descriptions of Arthonias, and it scarcely reveals the remarkable knowledge of the genus undoubtedly possessed by the writer. In order to bring out the feelings of Willey regarding the recent ideas as to the nature of lichens, I can not refrain from quoting him somewhat at length as follows: "I take this opportunity to express my regret that the American professors of botany have so

generally accepted the 'Schwendener theory,' * * * and this, too, simply as a dogma, without having acquainted themselves with the arguments against it by the eminent lichenographers of Europe, and by Professor Tuckerman in this country. * * * I should be sorry to think that these professors have joined in the conspiracy of silence toward the opposing arguments of such men as Nylander, Müller, Minks, Krempelhuber, Th. M. Fries, Tuckerman and others." I can not give the whole quotation, but it may be seen in the preface of the "Enumeration of the New Bedford Lichens." Willey does not with Nylander quite charge calumny, but he, no doubt, voices the sentiments of the greater number of lichenists of the period. However, it is not remarkable that a man whose botanical work was almost wholly confined to taxonomic studies of lichens should be slow to grasp the value of the recent morphological and physiological studies, and this failure in no way detracts from the great value of Willey's work on the American lichens. I was fortunate enough to have the benefit of his council to a limited extent a few years ago before increasing age forced him to give up his work, and have also had ample opportunity for inspecting his determinations, which were always most carefully made. Finally, we must not fail to state that to Willey belongs the credit for the completion of the second part of Tuckerman's Synopsis after the death of the author.

Passing over some minor workers, our space must now be devoted to the great American lichenist, Tuckerman. He stands out so pre-eminently as an American lichenist that something of his history is a proper part of the history of American lichenology. Born in 1817, he obtained his bachelor's degree in 1837, and two years later finished the law course at Harvard. In 1841 and 1842 he traveled in Europe and met the great lichenist, Elias Fries, at Upsala. Returning to this country, he accompanied Asa Gray to the White Mountains and began the difficult exploration which has rarely been excelled for completeness. That he began his botanical studies in early life and devoted himself chiefly to lichens from the first appears from the fact

that his first "Enumeration of some Lichenes of New England" was published when he was not more than twenty-two years old, and appears to have been read the year before. Excepting Halsey's work considered in the last period, this was the first work by an American, entirely devoted to lichens. His writings, even from the first, contained careful notes which show that he was possessed of a genuine love of botany and a marked adaptability for the work. Thus his meeting with Fries was not merely an incident of his first European trip, and his visits and excursions with this greatest lichenist of his time must have been a great inspiration in those days when botanists were few in number. Indeed, we can hardly estimate the value of this visit to American lichenology. In 1847, nearly ten years after Tuckerman began his work on lichens, appeared his "Synopsis of the Lichenes of New England, and other Northern States and British America." This work was the first to give descriptions and a classification of our lichens, and though it contained but 295 species with 20 new, it was of great importance as it formed a basis from which others could work. It has already been stated that at the same time Tuckerman began to issue his "Lichenes Americae Septentrionalis Exsiccate", this first issue of American specimens giving authentic plants with which collectors could compare their lichens. With the year 1847, then, our Tuckerman period begins. There is some doubt in the mind of the writer whether it might not be better to place the time back to the year when Tuckerman's first work appeared and make it close with 1886, the year of his death. Yet it appears on the whole that the better plan is to begin with the first appearance of a descriptive classification by Tuckerman and to close the period with the completion of the "Synopsis" which was Tuckerman's great contribution.

Tuckerman was more than a lichenist as his knowledge of the general botany of his day was quite comprehensive, while he was a widely read and scholarly man. His professorship in botany at Amherst began in 1858 and continued till his death, twenty-eight years later. But we

must confine our attention to his work upon the lichens. In this field his activity continued to the time of his death, and collections were determined by him, not only from all portions of the Western Hemisphere, but also from the Eastern Hemisphere and from the islands of the sea. How much labor and self-sacrifice is involved in such a task will be appreciated by those who have attempted a similar one even though upon a smaller scale, in some field of taxonomic study. This work brought Tuckerman a knowledge of lichen species possessed by very few even of the European lichenists, and culminated in his two great contributions to North American lichenology, the "Genera Lichenum" in 1872 and the "Synopsis", the first volume of which appeared in 1882 and the second in 1888. Of these two great works, we may venture a few words. The author was conservative in his view of genera and species and seemed to have followed Fries very largely in his classification of the American lichens. His views as to system of classification and as to generic and specific limitations can scarcely be expected to endure in all particulars. Yet his conservatism was by no means a fault, and has no doubt greatly aided in the study of our lichens. Plainly it was not possible for one man to do so much of the great constructive work in American lichenology and at the same time be given to hair-splitting discriminations as to generic and specific limitations. Tuckerman was to lichenology what Gray was to the study of our seed-plants, and we can not pay too high a tribute to the labors of these two men. Tuckerman's contributions to North American lichenology consist of 48 titles, but the number by no means measures the amount of work involved, for he aided others continually and much of his labor received no public recognition. Conservative as he was, his new species and varieties number some 365, about 250 of these being found on the North American continent, some 60 of the remainder on the island of Cuba, and nearly an equal number from various parts of the world and not to be regarded as North American. Including the Cuban lichens named by Tuckerman, the number of species and varieties described

in the two volumes of the "Synopsis", for North America, is approximately 1050, and this number is no doubt considerably below the whole number of North American lichens known by Tuckerman. Thus within the period, the number has grown from 295 to at least 1050, and following Willey's "Supplement", of 1887, no doubt 1225 or 1250 comes nearer to the number.

Tuckerman was pre-eminently a systematist, but some words are in order regarding his views on some other questions of lichenology. In regard to the theory of Schwendener as to the dual nature of lichens, he was more guarded in his statements than many of the other systematic lichenists of his day. While he readily admitted that there were some arguments in favor of the theory, he seems finally to have adopted the views of Minks, and like Müller and some others of his day thought that he had himself demonstrated the existence of the "microgonidia." This he regarded as establishing a boundary line between lichens and fungi. It is pleasant to note, however, that during the years of sharp debate, Tuckerman was always careful and considerate in his treatment of the question. It is also quite as pleasant a task to record that in a short paper entitled "Can Lichens be Identified by Chemical Tests," Tuckerman remarks that his own observations have led him to believe that such tests are scarcely reliable, a view which I suppose meets the approval of later lichenists generally, since we have reached more definite knowledge regarding the anatomy of these plants.

Excellent memoirs of Tuckerman by Willey, Gray and Farlow give much more of detail than can be incorporated here. Finally a considerable amount of good collecting and making of lists of lichens from limited areas must be passed unnoticed, the whole number of titles for the period amounting to 175.

THE RECENT PERIOD (1888 TO THE PRESENT TIME).

There seems to be a feeling extant that American lichenology has been neglected since the death of Tuckerman; but the facts to be brought out below do not bear out this

view, and no doubt botanists generally will be surprised at the statement that more than half of the known references to literature containing some reference to North American lichens belongs to the present short period of sixteen years. True the older titles are more difficult to find, but doubtless my present bibliography will not be very greatly increased. No recent American worker has accomplished so much as did Tuckerman in his long life; but the number of workers has increased, while the quantity and quality of work done by several of them is surely praiseworthy.

In considering the workers of this period, I shall again take up first the labors of Europeans who have aided, and then the American workers. Among the former may be mentioned first J. Müller, whose work on our lichens began as far back as 1877, whose titles dealing wholly or in part with North American species number no less than 24, and whose North American new species number approximately 125. Of these about 90 were described in the present period and add to our flora as known by Tuckerman. Next to Nylander, Müller is the European who has done most for American lichenology. E. Stizenberger had noticed some of our lichens, beginning as far back as 1861, but so far as I am able to ascertain, his only papers dealing wholly with our lichen flora are two, written in 1895. In 1890 he began examining the collections of H. E. Hasse, of California, and described quite a number of new species which have been published in papers by Hasse. Edward Wainio, of Helsingfors, has considered our *Cladonias* in his exhaustive "Monographia Cladoniarum Universalis" 1887-1898, and American students who would work on the genus must *learn how* to use his volumes. Dr. Wainio has in the last few years examined considerably more than 200 of my specimens of American *Cladonias* and a considerable amount of European material on which I have asked his aid. These specimens of the genus are very valuable, especially when it is stated that in all probability fully one-fourth of all American determinations of *Cladonias* would not endure Dr. Wainio's critical examination. That

the Cladonias are fairly well known is attested by the fact that Wainio found only a single new American form in all of the specimens submitted to him, including the most difficult. It will be interesting to note that Wainio regards the western hemisphere the richest field in *Cladonias*. The eminent botanist and lichenist, A. Zahlbruckner, of Vienna, has recently published two papers in which he describes 32 new North American lichens, from California, sent to him by E. Hasse. He has also named several other species collected by Hasse, and has examined a large number of my specimens, naming several, of which few have yet been published. The late Dr. F. Arnold, of München, devoted three papers to the lichens of Labrador and Newfoundland, 1896-1899. Though these papers record 175 species from Labrador and 367 from Newfoundland, I can find only a single new species recorded. When such able lichenists as Wainio and Arnold examine such large collections from America and find so little that is new, we are disposed to think that possibly the finding of new species is sometimes due to limited knowledge of these already described. However, this remark can have no bearing on the work of early students of our lichen flora when few species were known, nor is it directed toward the recent work of Stizenberger and Zahlbruckner on the comparatively little known lichen flora of our western coast, nor at that of the latter on the flora of Iowa and Minnesota, where new species surely are to be expected. Just here it may be recorded that of some three dozen Lecidioid lichens recently submitted to the student of the group, T. Hedlund of Upsala, and of the most obscure American material that has come to my hands, he returns not a single new species, though three are not yet reported as to species.

My bibliography is not yet in a condition to give exact numbers of new species by these European workers on our flora in the present period, but including some 75 species described by Nylander within the present period, the whole number of species added to our lichen flora by foreigners

since 1888 is not far from 230, all in the nature of additions to our flora as known to Tuckerman.

Turning to American workers of the period, we may consider first John Macoun, of Ottawa, Canada, most of whose work was done in the previous period, beginning as far back as 1877, but culminating in his "Catalogue of Canadian Lichens," 1902. In this catalogue is given a list of 614 lichens with notes on distribution and habitat. Macoun is not wholly given to lichenology, but during the last thirty years has, with his other collecting and study, accomplished a work that must be regarded by all future students of the lichen flora of northern United States and British America.

Next comes W. W. Calkins, a man possessed of a genuine love of nature and who has done telling work not only on our lichens, but on seed-plants and fungi as well. His first papers on lichens appeared in 1885, and he has since published eight short papers and "The Lichen Flora of Chicago and Vicinity," 1896. This last paper is an important contribution, consisting of a short historical sketch, a descriptive catalogue of the 125 lichens of the area and the first bibliography of lichens published in this country. But Mr. Calkins will be remembered rather as a keen-eyed collector of plants, who, after doing a large amount of general work in the south, devoted himself entirely to the lichens during his last few winters in the south, added greatly to our knowledge of the lichen flora and discovered 26 new species. Calkin's species have been widely distributed in the last few years and are to be found in many American herbaria.

J. W. Eckfeldt began his work in 1877 and has since determined largely for various collectors, but his first paper appeared in 1886, and following this the "Catalogue of the Lichen Flora of Florida," published with Calkins in 1887. This is a list of 330 lichens, of which 8 are new and named by Nylander and Willey. But Eckfeldt's most important contribution is "An Enumeration of the Lichens of New Foundland and Labrador," 1895, in which he lists more than 450 forms and gives descriptions of three

of his own new species and one each by Hulting and Arnold. In some of Eckfeldt's other papers (in Bull. Torr. Bot. Club) I find 25 new species described. His titles number 13 only, but he has a wide knowledge of lichen species.

The first paper by Clara E. Cummings appeared in 1888, and since that time she has published several papers, has collected largely in New England and California and has done a large amount of work in determining for other collectors. Her chief work, however, has been in the distribution of exsiccati known as "Decades of North American Lichens," and a second edition under the name, "Lichenes Boreali-Americani." The work of determination of the specimens sent out has been largely done by Miss Cummings, except for the aid given by T. A. Williams during the last years of his life, and frequent use of the sets for study and comparison has demonstated that the work is very carefully and accurately done. This critical and time-consuming work has given Miss Cummings a wide knowledge of lichen species, and American botanists may very justly look to her for more good work in a field where labor of the best quality is much needed. Her recent paper, "The Lichens of Alaska," is one of the best contributions of the period.

T. A. Williams' first paper appeared in 1889, and he was a frequent contributor till his death in 1900. Papers on the Nebraska, the Mexican, the Black Hills and the Bahama lichens are his principal contributions. But his work with Miss Cummings on the exsiccati also aided greatly during the few years that he was connected with that work. Everything done by him bore the stamp of critical study, and his early death was a serious loss to American lichenology. His titles number 13.

Albert Schneider's first paper appeared in 1894, and during the next few years several papers appeared in the Torrey Bulletin. However, these are unimportant when compared with his "Text-book of General Lichenology," which appeared in 1897 and constitutes the most important contribution to lichenology by an American since

Tuckerman. The departure from Tuckerman's classification and especially the change in generic limitations seem in the main to be an improvement, while the chapters on morphology and physiology can not fail to be helpful to all students of lichenology. All in all the book is one of the most helpful contributions to lichenology. However, to some just criticism which the work has received, I may be permitted to add that careful studies of the thalli and apothecia of some 500 species of the genera given in the text has shown plainly that a considerable number of the statements and drawings intended to bring out generic characters are surely based upon the examination of a small number of species. Finally, Schneider's briefer "Guide to the Study of Lichens," which appeared in 1898, will surely prove valuable to the beginner in the study of lichens.

H. E. Hasse, of California, has in recent years contributed largely to a knowledge of the lichen flora of his State. His first paper appeared in 1895, and quite a number has been added since. In these papers Hasse has listed 434 lichens from California and the coast islands. Of these 96 were new to North America and 64 new species. Dr. Hasse has had the aid of Stizenberger, Nylander and Zahlbruckner, and the work still in progress has already added more lichens to our flora than any other of the present period.

The first paper by the present writer appeared in 1895, and others have followed at frequent intervals, aggregating 24 titles and about 500 pages. For the work in Iowa, 226 species have been published from various parts of the State. The vicinity of Fayette, Iowa, the only area in the State even fairly well studied, has yielded 205 forms which have been published, while a number of other species from the region and recently determined as old or new species, have not yet been published. Thus it is apparent that our knowledge of the lichen flora of Iowa is yet quite incomplete. The work in Minnesota is much more complete, the whole number of forms listed being approximately 500. However, while this is the largest number of

lichens yet given for any State, a complete compilation for Massachusetts would surpass it, and I have already committed myself to the statement that there are probably 700 lichen forms within the boundaries of Minnesota. The work has added 30 new North American forms, of which ten are new, and has added about 130 lichens new to the interior of North America, or to the Mississippi valley. The Minnesota papers and some others have contained extended contributions to geographical and ecological distribution. Also may be mentioned an American and European distribution of exsiccati reaching approximately 15,000 specimens.

G. J. Pierce began his work in 1898, and his contributions to morphological and physiological problems are important as is also the paper by W. C. Sturgis on "The Carpologic Structure and Development of the Collemaceae and allied Groups." Also, during the last three years, Mrs. Carolyn W. Harris has been contributing to "The Bryologist," a series of illustrated articles, which must prove very helpful to beginners in the study of lichens. Finally, it is with regret that I simply record the names of E. E. Bogue, H. A. Green, Chas. Mohr, A. C. Waghorne and A. B. Langlois, all of whom have contributed to our knowledge recently through their collecting or writing. Also A. M. Hue's "Lichenes Exotici," published in 1892, should have been mentioned with other works by Europeans, as American students of distribution must refer to it constantly, nor has it been possible in the time allotted even to mention every helpful paper.

It is not possible in the present state of knowledge to give the exact number of species of our lichens described since Tuckerman's time, or to give exactly the whole number of lichens added to our flora since 1888. However, the whole number of lichen forms added is not far from 360, and the number of new ones 265. This gives us a lichen flora of approximately 1,600 species and varieties. However, the post-Tuckermanian work is by no means to be regarded as merely additions to the flora, for the work of Schneider and the morphological, physiological and

ecological papers are surely more important. The titles for the present period number 222, or one more than half of the whole 443 known titles for the four periods.

The bibliography of North American lichens published by Calkins in 1896 numbered 122 titles. To this the present writer added 101 in a paper published in 1898, making a total of 223 down to the date of Calkin's paper, April, 1896. Since then the work has gone forward till my number is 433, including all obtainable to the present time, but by far the larger number of additions being from obscure places prior to 1896. Still a new title comes to light frequently, and the bibliography is not yet ready for publication with this paper. Among the 443 titles, are quite a number concerning the lichen flora of our arctic regions, which have not been mentioned in this paper. While these are all minor papers, the number of species listed in them is upward of 300 and adds considerably to our knowledge of the lichens of the region.

The facts brought out in the discussion of the present period show that a good deal has been accomplished in the few years. However, several of the workers of the period are still busy with their studies, and the information regarding their work must be taken as in no sense final or complete. Also it should be stated before concluding that there is not an area of considerable size on the American continent which will not still yield lichens new to the region, and that our knowledge of the lichen flora as a whole is still quite meager. However, there is also great need of serious studies in the various genera, not one of which has yet been monographed for America. And while all this is true, morphology, physiology and ecology will all continue to furnish American workers with labor quite as interesting and productive of results.

In closing it may be repeated that it is not supposed that the bibliography upon which this historical statement is based is more than approximately correct and complete; and it is certain that some errors of statement have been made, while very possibly something of real importance may have been omitted from the discussion. It is to be

hoped that the bibliography may be published at an early date, and in the interval any suggestions from botanists as to omissions or errors in statement will be very welcome and will receive careful consideration. Finally, in closing I wish to express my thanks to many American and European lichenists, and to other botanists of our country, who have answered many questions and aided in looking over literature. Also I am under obligations to the lichenists of two continents for the photographs from which the lantern slides shown were made.

APPENDIX.

At the last moment it has seemed best to give some statement regarding bibliography; and since it is impossible to give a complete statement of all titles with adequate explanation as to contents in all instances, it has seemed best to add here the names of all authors in whose papers anything regarding lichens has been found. With these names appears the year in which the first article by the author containing any reference to North American lichens appeared, and this is followed by a figure indicating the number of such titles by the author. While this presentation is not all that could be desired, it is hoped that it may prove useful to workers in American lichenology; and I shall also be glad to aid any especially interested from my bibliography cards which give full data. The whole number of articles indicated by the numbers after each author's name is considerably more than 443. This is due partly to a repetition in instances of joint authorship, and in part also to the finding of some additional titles and authors after the address was delivered. Finally, I shall be very greatly obliged to botanists for any additions to the authors or numbers of titles indicated, or for any earlier dates of publication of any thing containing references to lichens by any of the authors.

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